

Combat-Related Posttraumatic Headache: Diagnosis, Mechanisms of Injury, and Challenges to Treatment

CPT Matthew Kozminski, DO, MC, USA

Context: Studies have revealed the rates of posttraumatic stress disorder (PTSD) and concussion among US soldiers returning from combat, but only one study has focused on the subpopulation of soldiers with headache.

Objectives: To determine the rate of PTSD among US soldiers with comorbid chronic posttraumatic headache attributed to head injury, to identify common mechanisms of head injury, and to identify the common challenges a health-care provider must face when treating US soldiers with chronic posttraumatic headache attributed to head injury.

Methods: Between July 2007 and December 2008, the author examined 42 US Army soldiers with complaint of chronic headache. In March 2009, the author retrospectively reviewed the outpatient records for diagnoses, mechanisms of injury, and challenges to treatment.

Results: The rate of concussion, defined by the Defense and Veterans Brain Injury Center Working Group on the Acute Management of Mild Traumatic Brain Injury in Military Operational Settings, was 95%. The rate of PTSD, as determined either with the PTSD Checklist or by confirming a prior diagnosis by another healthcare provider, was 97.9%. Both rates are remarkably higher than rates reported in the literature. The most common mechanisms of injury were proximity to blast (18 [45.2%]) and direct target of blast (15 [35.7%]). The most common treatment challenges were overuse of headache-abortive medications (10 [23.8%]) and poor patient follow-up (7 [16.7%]).

Conclusion: Physicians should be aware that the rates of PTSD and concussion for US soldiers, most often linked to involvement in or proximity to a blast, are higher for soldiers complaining of chronic headache. Physicians should also be aware of the potential for overuse of medications in this patient population.

J Am Osteopath Assoc. 2010;110(9):514-519

Since 2007, evaluating and treating US soldiers returning from combat with a complaint of headache has become an integral component of neurology residency training at Madigan Army Medical Center. At about that time, more formal traumatic brain injury (TBI) screening programs were being established at Fort Lewis for US soldiers returning from combat tours, thus leading to an increased number of neurology consultations for soldiers with headache as a comorbidity. Although studies¹⁻⁴ have reported rates of posttraumatic stress disorder (PTSD) and concussion or mild TBI for US soldiers returning from combat settings, only one study attempted to focus on a subpopulation of soldiers with a comorbid complaint of headache.² Furthermore, all were questionnaire-based studies of soldiers returning from combat tours. Questionnaire-based studies may have low response rates and therefore may introduce volunteer bias.

Based on the hypothesis that the rates of PTSD and concussion or mild TBI are higher in soldiers complaining of chronic headache and that these rates will be higher when data are obtained from direct face-to-face patient interviews, I conducted a retrospective review of patient records from soldiers with complaint of chronic headache. Records were evaluated for diagnosis, mechanism of injury, and barriers to treatment.

A significant portion of these soldiers are transitioning to a civilian life for a variety of reasons; thus, it is imperative that the various aspects of these soldiers' lives, particularly the rate of PTSD with TBI, patient follow-up, and medication overuse, are shared with civilian counterparts—primary care physicians and physician specialists alike.

Methods

Between July 2007 and December 2008, I completed three separate outpatient clinic rotation blocks as a neurology resident at Madigan Army Medical Center in Tacoma, Washington, during my postgraduate third and fourth years of training. I

Dr Kozminski was a neurology resident at Madigan Army Medical Center in Tacoma, Washington, when he conducted the present study.

Disclaimer: The opinions and assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army, Department of Defense, or the US Government.

Financial Disclosure: None reported.

Address correspondence to CPT Matthew Kozminski, DO, MC, USA, Chief, Neurology Clinic, Darnall Army Medical Center, 36000 Darnall Loop, Fort Hood, TX 76544.

E-mail: mpkst17@yahoo.com.

Submitted September 9, 2009; revision received November 23, 2009; accepted May 2, 2010.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 01 SEP 2010		2. REPORT TYPE		3. DATES COVERED 00-00-2010 to 00-00-2010	
4. TITLE AND SUBTITLE Combat-Related Posttraumatic Headache: Diagnosis, Mechanisms Of Injury, And Challenges To Treatment				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Madigan Army Medical Center, Tacoma, WA, 98431				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Journal of the American Osteopathic Assoc, September 1, 2010 vol. 110 no. 9 514-519					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 7	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

also completed the required half day per week of continuity clinic. During this time frame, I examined 42 US Army soldiers with a history of a deployment to Iraq or Afghanistan and who had complaint of chronic headache. At each encounter, I attempted to confirm diagnosis of PTSD, if appropriate, and inquired whether headache onset was temporally related to injury or concussive symptoms. I obtained as much detail as possible regarding each soldier's combat-related injury that might have triggered headache.

Examinations included medical evaluation board (MEB) consultations and temporary duty retirement list evaluations. In MEB consultations, the consultant assesses the soldier's fitness for duty and determines whether the soldier should be referred to an evaluation board for consideration of medical discharge as a result of his or her medical condition. Temporary duty retirement list evaluations comprise examinations of soldiers who have been medically discharged from the military and who return for annual evaluations to determine whether their conditions have improved enough for possible reinstatement into active-duty military service.

Many of the soldiers had a preexisting diagnosis of PTSD from another healthcare provider before I examined them; however, if this was not the case, I conducted an in-person interview, with the PTSD Checklist⁵ used as a guide to identify the diagnosis (*Appendix 1*). Each soldier was asked about symptoms of concussion⁶ as they appear on the Military Acute Concussion Evaluation (MACE) form (*Figure 1*). If concussive symptoms temporally related to headache onset and injury were in question, I tried to ensure that the soldier met the definition of concussion provided by the Defense and Veterans Brain Injury Center Working Group on the Acute Management of Mild Traumatic Brain Injury in Military Operational Settings (*Appendix 2*).⁷

If a soldier met the definition of concussion, noted headache onset temporally related to the event that precipitated the concussion, or noted exacerbation of a prior headache disorder temporally related to the event that precipitated concussion, then a formal diagnosis of chronic posttraumatic headache attributed to mild head injury was given, as defined by the International Classification of Headache Disorders (ICHD-II) criteria⁸ (*Appendix 3*).

In March 2009, I retrospectively reviewed the outpatient records of these 42 soldiers. On review, any of the following treatment or management challenges were noted: analgesia or opioid overuse, overuse of prescribed headache-abortive medications, mistrust of providers or frustration with care, poor compliance with patient follow-up, any questionable legitimacy of complaints (eg, possible embellishment of symptoms for secondary gain, possible somatization, factitious disorder), and expressed dislike of taking medications. The diagnosis of PTSD and the description of the reported mechanism of injury as reported in the outpatient record were also noted on retrospective review.

If any soldier was referred to a neuropsychologist for a

- ☐ Headache
- ☐ Dizziness
- ☐ Memory problems
- ☐ Balance problems
- ☐ Nausea or vomiting
- ☐ Difficulty concentrating
- ☐ Irritability
- ☐ Visual disturbances
- ☐ Ringing in the ears

Figure 1. Symptoms of concussion. **Source:** Item VIII, Military Acute Concussion Evaluation (MACE). Available at <http://www.cs.amedd.army.mil/filedownload.aspx?docid=930>.

formal evaluation, the encounters were also retrospectively reviewed to determine whether the neuropsychologist thought that any complaints had questionable legitimacy.

Results

Of the reviewed soldiers' records, 5 (12%) were strictly one-time consultations for either an MEB or a temporary duty retirement list evaluation. Seven soldiers (17%) were eventually referred for MEB consultation, and 5 (12%) left the military for non-medical reasons. Overall, 17 soldiers (40.4%) had already transitioned or were transitioning to a civilian life for a variety of reasons; long-term follow-up of these particular soldiers was not possible. However, I followed up with most for the purposes of routine care of their symptoms until they transitioned to a civilian life, were discharged from my care, or until I graduated from the residency program. Follow-up care is not described in the present study.

The most commonly reported mechanism of injury (19 [45.2%]) leading to a concussion or mild TBI was close proximity to a blast; that is, soldiers reported experiencing the effects of a shock wave secondary to a nearby blast but not being direct targets of an explosive device. In addition, a substantial proportion of soldiers (15 [35.7%]) reported being inside a physical structure or military vehicle that was the direct target of an explosive device. Smaller proportions of soldiers reported vehicle rollovers or crashes (4 [9.5%]) or falls related to combat scenarios unrelated to explosions (4 [9.5%]) (*Figure 2*).

Overall, 40 soldiers (95%) met the definition of concussion⁷; however, only 15 soldiers (36%) could account for a witnessed period of definite loss of consciousness, and only 15 (36%) could account for a definite blow to the head. For those who could not account for a definite blow to the head, many implied that the combat situation at the time of injury generated such a fearful or stressful response that the details of the head injury

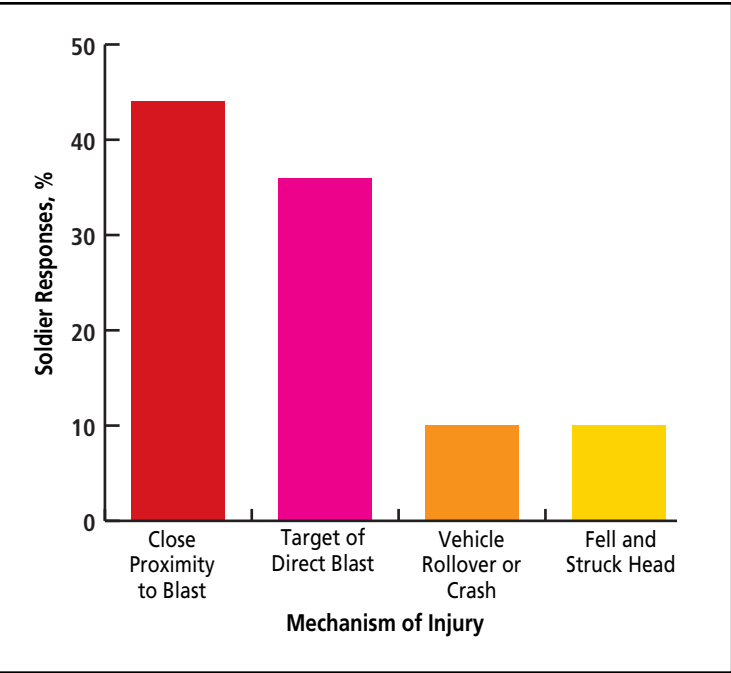


Figure 2. Categories of injuries as reported by US soldiers (N=42) in the present retrospective review.

could not be recalled. The majority of these individuals at least agreed that although they could not offer an exact or accurate account of possible mild head injury, they did experience the effects of a blast-related shock wave.

Overall, 41 soldiers (98%) had PTSD, as determined either by prior diagnosis or by an in-person interview with the PTSD Checklist⁵ used as a guide. According to patient interview and documentation in outpatient records, 3 soldiers (7%) probably had a predeployment history of a primary headache disorder; however, all agreed that their headache disorder was exacerbated by their respective concussion or mild TBI.

Of the many challenges regarding the management of these soldiers, the most common were overuse of headache-abortive medications and overuse of analgesia or opioids (Table). The most commonly overused abortive medications were isometheptene mucate, dichloralphenazone, and acetaminophen; acetaminophen, butalbital, and caffeine; and serotonin receptor agonist medications. Unfortunately, many soldiers with a history of analgesia or opioid overuse took these medications for comorbid painful conditions other than headache.

Many soldiers underwent formal consultation by a neuropsychologist, most for complaints of chronic neurocognitive deficits after head injury. Overall, only 2 soldiers (4.8%) were reported as having questionably legitimate complaints (embellishment of symptoms, factitious disorders, or somatization).

Comment

In the past, concussion was one of the most commonly overlooked symptoms of blast-injured soldiers.⁹ More recent studies have indicated that the rates of concussion or mild TBI for US soldiers deployed to combat range from 12% to 41%;¹⁻⁴ the rates of PTSD are reported to be 11% to 43.9%.¹⁻⁴ These rates of concussion or mild TBI and PTSD are discordant with the rates reported in the present study—95% and 97.9%, respectively.

A survey-based, cross-sectional study of Iraq or Afghanistan veterans conducted at the Washington DC Veterans Affairs Medical Center reported rates of 12% for mild TBI and 11% for PTSD.¹ Evans Army Community Hospital⁴ reported clinician-confirmed TBI in 22.8% of soldiers, using the responses of the Warrior Administered Retrospective Casualty Assessment (WARCAT)¹⁰ and clinician interview. The Walter Reed Army Institute of Research reported injury and loss of consciousness in 4.9% of soldiers and injury and altered mental status in 10.3%.³ Of note, those with reported loss of consciousness had a

much higher rate of PTSD than those who did not report loss of consciousness or injuries.³

None of these prior studies examined the subpopulation of soldiers suffering from chronic headache. In addition, all of these studies were reliant on self-administered questionnaires, which may have lead to volunteer bias. For the questionnaire-based studies at the Washington DC Veterans Affairs Medical Center and Walter Reed Army Institute of Research, the rates of nonresponders were 62.9% and 7%, respectively.^{1,3}

A retrospective cohort study² at Madigan Army Medical Center of 81 US soldiers seen at the neurology clinic for chronic headache demonstrated a history of head or neck trauma with

Table Common Management Challenges in US Soldiers With Chronic Headache (N=42)*	
Challenge	Soldiers, No. (%)
Analgesia or opioid overuse	6 (14.2)
Overuse of abortive medication†	10 (23.8)
Mistrust or frustration	3 (7.1)
Poor follow-up	7 (16.7)
Questionable legitimacy of complaints	2 (4.8)
Dislike of taking pills	6 (14.3)
* Soldiers were directly asked about these items as part of the standard patient interview. Percentages do not total 100 because some soldiers did not meet any of the above criteria.	
† Nonopioid medications typically prescribed for abortive headache therapy by healthcare providers, including triptan medications; isometheptene micate, dichloralphenazone, and acetaminophen; and acetaminophen, butalbital, and caffeine.	

concussion, with or without loss of consciousness, in 41% of soldiers and a high likelihood of PTSD in 6%. Although that study did target soldiers complaining of chronic headache, portions of the data relied on self-administered questionnaires, which again probably led to volunteer bias.

For all 42 soldiers described in the present study, the diagnosis of concussion or mild TBI and PTSD was considered by a face-to-face interview with a neurology resident (M.K.) and not reliant on self-administered questionnaires, thus eliminating volunteer bias. In addition, these soldiers were known to have a comorbid complaint of headache in addition to a history of combat-related injury.

Role of Osteopathic Medicine

Osteopathic medicine provides a patient-centered approach that integrates recognized and rational healing methods, including osteopathic manipulative treatment (OMT), to improve the health and physiological function of patients.¹¹ There is some basis for the belief that physical manipulation, many techniques of which focus on the cervical spine, can be beneficial in treating certain headache disorders.

Biondi¹² postulated that head pain may frequently arise from or be influenced by various soft tissues and neurogenic or osseous structures of the head, neck, and upper body. Pain elicits a heightened response of the sympathetic nervous system that can cause vasoconstriction, ischemia, chemical changes, more muscle contraction, and pain, creating a vicious cycle.¹³ Techniques of OMT are believed to improve circulation; release restrictions in joints; reduce tension in the muscles, fascia, and dura mater; decrease nociceptive input; and promote the normalization or calming of the central nervous system.¹³ Prior literature has emphasized the importance of focus on the occipitoatlantal joint, occipital condyles, and occipitomastoid joint; sphenobasilar syncondrosis in migraine; and use of craniosacral techniques for cervicogenic headache.¹⁴⁻¹⁶ In at least one small case series, OMT was shown to be a helpful adjunct therapy to traditional pharmacologic therapies for US soldiers suffering from posttraumatic headache attributed to mild head injury.¹⁷

Conclusion

Soldiers returning from combat-related deployments to Iraq or Afghanistan with a complaint of chronic headache have higher rates of concussion or mild TBI and PTSD than those who do not complain of chronic headache. The overall rates of concussion or mild TBI and PTSD are probably underreported when based on the results of self-administered questionnaires; this discrepancy may be related to volunteer bias and, in some cases, nonresponders. The most common treatment challenges for soldiers with chronic posttraumatic headache attributed to head injury are the overuse of typical headache abortive medications and poor patient follow-up. Although OMT may be a useful adjunct therapy for combat-related chronic posttraumatic headache attributed to mild head injury, further studies need to be performed.

References

1. Schneiderman AI, Braver ER, Kang HK. Understanding sequelae of injury mechanisms and mild traumatic brain injury incurred during the conflicts in Iraq and Afghanistan: persistent postconcussive symptoms and posttraumatic stress disorder. *Am J Epidemiol*. 2008;167(12):1446-1452.
2. Theeler BJ, Erickson JC. Mild head trauma and chronic headaches in returning US soldiers. *Headache*. 2009;49(4):529-534.
3. Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Castro CA. Mild traumatic brain injury in U.S. soldiers returning from Iraq. *N Engl J Med*. 2008;358(5):453-463.
4. Terrio H, Brenner LA, Ivins BJ, et al. Traumatic brain injury screening: preliminary findings is a US Army brigade combat team. *J Head Trauma Rehabil*. 2009;24(1):14-23.
5. Weathers F, Litz B, Herman D, Huska J, Keane T. The PTSD Checklist (PCL): reliability, validity, and diagnostic utility. Paper presented at: Annual Convention of the International Society for Traumatic Stress Studies; San Antonio, TX; 1993.
6. Military Acute Concussion Evaluation (MACE). <http://www.cs.amedd.army.mil/filedownload.aspx?docid=930>. Accessed August 19, 2010.
7. Management of Concussion/mTBI Working Group, Department of Veterans Affairs. *VA/DoD Clinical Practice Guideline for Management of Concussion/Mild Traumatic Brain Injury*. Washington, DC: Department of Veterans Affairs and Department of Defense; March 2009. <http://www.dvbc.org/images/pdfs/providers/VADoD-CPG—Concussion-mTBI.aspx>. Accessed August 19, 2010.
8. Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders: 2nd edition. *Cephalalgia*. 2004;24(suppl 1):9-160.
9. Scott SG, Belanger HG, Vaderploeg RD, Massengale J, Scholten J. Mechanism-of-injury approach to evaluating patients with blast-related polytrauma. *J Am Osteopath Assoc*. 2006;106(5):265-270.
10. Soldier Readiness Process Fort Carson TBI Questionnaire, TBI Reassessment (Fort Carson) and Fort Carson TBI Educational Handout. <http://www.evans.amedd.army.mil/srp/WARCAT%20DEC%202007.xls>. Accessed August 19, 2010.
11. Kuchera ML. Applying osteopathic principles to formulate treatment for patients with chronic pain. *J Am Osteopath Assoc*. 2007;107(11 suppl 6):ES28-ES38.
12. Biondi DM. Physical treatments for headaches: a structured review. *Headache*. 2005;45(6):738-746.
13. Anderson RE, Seniscal C. A comparison of selected osteopathic treatment and relaxation for tension-type headaches. *Headache*. 2006;46(8):1273-1280.
14. Biondi DM. Cervicogenic headache: a review of diagnostic and treatment strategies. *J Am Osteopath Assoc*. 2005;105(4 suppl 2):S16-S21.
15. Batchelor K, Gamber R. Migraine and OMT. *Am Acad Osteopath J*. 2008;18(1):30-33.
16. Bernhardt EF. Cranial osteopathy for migraine headaches. *Cranial Letter*. 1995;48(1):4-6.
17. Kozminski M, Kozminski T. OMT as an adjunct therapy for post-traumatic headache in U.S. soldiers: a case series. *Am Acad Osteopath J*. 2009;19(2):23-24.

(Appendices appear on pages 518 and 519.)

Appendix 1

The Posttraumatic Stress Disorder (PTSD) Checklist is a 17-item questionnaire in which each item is scored from 1 to 5. For example, a response of "not at all" is scored as 1, and a response of "extremely" is scored as 5. The patient must have a cumulative score of 50 or greater to receive a diagnosis of PTSD. The version shown here is the military version of the checklist. The checklist has been modified for graphic enhancement and minor style issues only.

	Not At All	A Little Bit	Moderately	Quite a Bit	Extremely
1. Repeated, disturbing memories, thoughts, or images of a stressful military experience?					
2. Repeated, disturbing dreams of a stressful military experience?					
3. Suddenly acting or feeling as if a stressful military experience were happening again (as if you were reliving it)?					
4. Feeling very upset when something reminded you of a stressful military experience?					
5. Having physical reactions (eg, heart pounding, trouble breathing, or sweating) when something reminded you of a stressful military experience?					
6. Avoid thinking about or talking about stressful military experiences or avoid having feelings related to it?					
7. Avoid activities or talking about a stressful military experience or avoid having feelings related to it?					
8. Trouble remembering important parts of a stressful military experience?					
9. Loss of interest in things that you used to enjoy?					
10. Feeling distant or cut off from other people?					
11. Feeling emotionally numb or being unable to have loving feelings for those close to you?					
12. Feeling as if your future will somehow be cut short?					
13. Trouble falling or staying asleep?					
14. Feeling irritable or having angry outburst?					
15. Having difficulty concentrating?					
16. Being "super alert" or watchful on guard?					
17. Feeling jumpy or easily startled?					

Appendix 2

Definition of concussion used in the present study. Source: The Management of Concussion—TBI Working Group. VA/DoD Clinical Practice Guideline for Management of Concussion/Mild Traumatic Brain Injury. Washington, DC: Department of Veterans Affairs and Department of Defense; March 2009. <http://www.dvbc.org/images/pdfs/providers/VADoD-CPG—Concussion-mTBI.aspx>. Accessed August 19, 2010.

A traumatically induced structural injury and/or physiologic disruption of brain function as a result of an external force that is indicated by new onset or worsening of at least one of the following clinical signs immediately following the event:

- Any period of loss of or a decreased level of consciousness
- Any loss of memory for events immediately before or after the injury (posttraumatic amnesia)
- Any alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc) (alteration of consciousness/mental state)
- Neurologic deficits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc) that may or may not be transient
- Intracranial lesion

External forces may include any of the following events: the head being struck by an object, the head striking an object, the brain undergoing an acceleration/deceleration movement without direct external trauma to the head, a foreign body penetrating the brain, forces generated from events such as a blast or explosion, or other forces yet to be defined.

The above criteria define the event of a traumatic brain injury (TBI). Not all individuals exposed to an external force will sustain a TBI, but any person who has a history of such an event with immediate manifestation of any of the above signs and symptoms can be said to have had a TBI.

Appendix 3

The International Classification of Headache Disorders (ICHD-II) criteria for chronic posttraumatic headache attributed to head injury. Source: Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders: 2nd edition. Cephalalgia. 2004;24(suppl 1):9-160.

Chronic Posttraumatic Headache Attributed to Mild Head Injury

- A. Headache, no typical characteristics known, fulfilling criteria C and D
- B. Head trauma with all of the following:
 1. Either no loss of consciousness or loss of consciousness <30 minutes in duration
 2. Glasgow Coma Scale ≥ 13
 3. Symptoms and/or signs diagnostic of concussion
- C. Headache develops within 7 days after head trauma
- D. Headache persists for >3 months after head trauma

Chronic Posttraumatic Headache Attributed to Moderate or Severe Head Injury

- A. Headache, no typical characteristics known, fulfilling criteria C and D
- B. Head trauma with at least one of the following:
 1. Loss of consciousness for >0 minutes
 2. Glasgow Coma Scale <13
 3. Post-traumatic amnesia for >48 hours
 4. Imaging demonstration of a traumatic brain lesion (cerebral hematoma, intracerebral and/or subarachnoid hemorrhage, brain contusion and/or skull fracture)
- C. Headache develops within 7 days after head trauma or after regaining consciousness following head trauma
- D. Headache persists for >3 months after head trauma